

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference P100551	<div style="display: flex; justify-content: space-between;"> <div style="text-align: center;">FOR FURTHER ACTION</div> <div style="text-align: right;">see Form PCT/ISA/220 as well as, where applicable, item 5 below.</div> </div>	
International application No. PCT/SG2004/000333	International filing date (<i>day/month/year</i>) 12 October 2004	(Earliest) Priority Date (<i>day/month/year</i>) 14 October 2003
Applicant AGENCY FOR SCIENCE, TECHNOLOGY AND RESEARCH et al		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of **5** sheets.

☐ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

a. With regard to the language, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ The international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

b. ☐ With regard to any nucleotide and/or amino acid sequence disclosed in the international application, see Box No. I.

2. ☐ Certain claims were found unsearchable (See Box No. II).

3. ☐ Unity of invention is lacking (See Box No. III).

4. With regard to the title,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the abstract,

☐ the text is approved as submitted by the applicant.

☒ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. With regard to the drawings,

a. the figure of the drawings to be published with the abstract is Figure No. **3b**

☒ as suggested by the applicant.

☐ as selected by this Authority, because the applicant failed to suggest a figure.

☐ as selected by this Authority, because this figure better characterizes the invention.

b. ☐ none of the figures is to be published with the abstract.

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Box No. IV Text of the Abstract (Continuation of item 5 of the first sheet)

A memory cell (310) for a magnetic memory device (300) includes a free layer (311), a cap layer, an antiferromagnetic layer, and a synthetic antiferromagnetic layer which comprises two or more than two ferromagnetic layers that are anti-ferromagnetically coupled through non-magnetic space layers. The synthetic anti-ferromagnetic layer is pinned by the antiferromagnetic layer. The antiferromagnetic layer and the synthetic antiferromagnetic layer form a synthetic antiferromagnetic pinned (SAFP) recording layer. The magnetization of the SAFP recording layer can be changed by combining a heating process and an external field induced from currents flowing along the bit line (320) and the word line (330). Therefore, a MRAM with high density, high thermal stability, low power dissipation and high heat tolerance can be achieved after introducing the SAFP recording layer due to the high volume and anisotropy energy of the SAFP recording layer.

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/SG2004/000333

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl. ⁷: G11C 11/15

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

DWPI: IPC G11C 11/15 and keywords: magnetoresistive random access memory, synthetic antiferromagnetic pinned, layer, heat, thermal, ferromagnetic, antiferromagnetic, pinned and similar terms

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P, A	US 6728132 B (DEAK) 27 April 2004 Entire document	1-21
P, A	US 2003/0198113 A (ABRAHAM et al.) 23 October 2003 Entire document	1-21
A	US 2002/0089874 A (NICKEL et al.) 11 July 2002 Entire document	1-21
A	US 6418048 B (SIN et al.) 9 July 2002 Entire document	1-21

☒ Further documents are listed in the continuation of Box C☒ See patent family annex

* Special categories of cited documents:	
"A" document defining the general state of the art which is not considered to be of particular relevance	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"E" earlier application or patent but published on or after the international filing date	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search
17 December 2004Date of mailing of the international search report
06 JAN 2005

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/SG2004/000333

C (Continuation).

DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 6385082 B (ABRAHAM et al.) 7 May 2002 Entire document	1-21

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/SG2004/000333

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report				Patent Family Member			
US	6728132	US	2003189842	US	2004152218	WO	03085674
US	2003198113	WO	03092014				
US	2002089874	CN	1365117	EP	1225592	JP	2002245774
		US	2003123282				
US	6418048	NONE					
US	6385082	NONE					
Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.							
END OF ANNEX							

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